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**Design and Application of  
some Mechanical Appliances**

**Civil Engineer**

**1911**



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# DESIGN AND APPLICATION OF SOME MECHANICAL APPLIANCES

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BY  
OSCAR EMIL STREHLOW

B. S. UNIVERSITY OF ILLINOIS, 1896

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## THESIS

SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE

DEGREE OF  
CIVIL ENGINEER

IN

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1911



U N I V E R S I T Y   O F   I L L I N O I S  
T H E   G R A D U A T E   S C H O O L

April 1, 1911

I hereby recommend that the thesis prepared under my personal supervision by OSCAR EMIL STREHLOW entitled DESIGN AND APPLICATION OF SOME MECHANICAL APPLIANCES be accepted as fulfilling this part of the requirements for the degree of CIVIL ENGINEER.

Ira O. Baker.  
Head of Department

Recommendation concurred in:

Am. Talbot

Frederick M. Mann

COMMITTEE ON FINAL EXAMINATION.





## INTRODUCTORY.

The mechanical appliances which were selected for consideration in this thesis were designed by the author to meet some requirements in connection with the following construction work of James O. Heyworth, Engineer and Contractor, Chicago, Illinois:-

- (1.) Track elevation of the Chicago Junction Railroad.
- (2.) Construction of the Hydro-Electric Plant of the Economy Light and Power Company, Dresden Heights, Illinois.
- (3.) Construction of five sections of the North Shore Channel of The Sanitary District of Chicago.

Special conditions, existing in each case, governed the design of the three, novel, original devices.

The first appliance to be presented is a dump car, illustrated by drawings, Plate I, and photographs A, B and C; the second a skip, illustrated by drawings, Plate II and III; and the third a cable thimble, illustrated by drawings IV and V and photograph D.

The author has attempted to state, and illustrate, the functions which the devices are intended to perform; to describe fully their construction and advantages over similar appliances, and their applications in other fields than those in which similar appliances have been used.

The design of the dump car is such as to make the use of portable tracks on top of gondola cars, containing concrete material, a possibility and great economy has resulted therefrom.



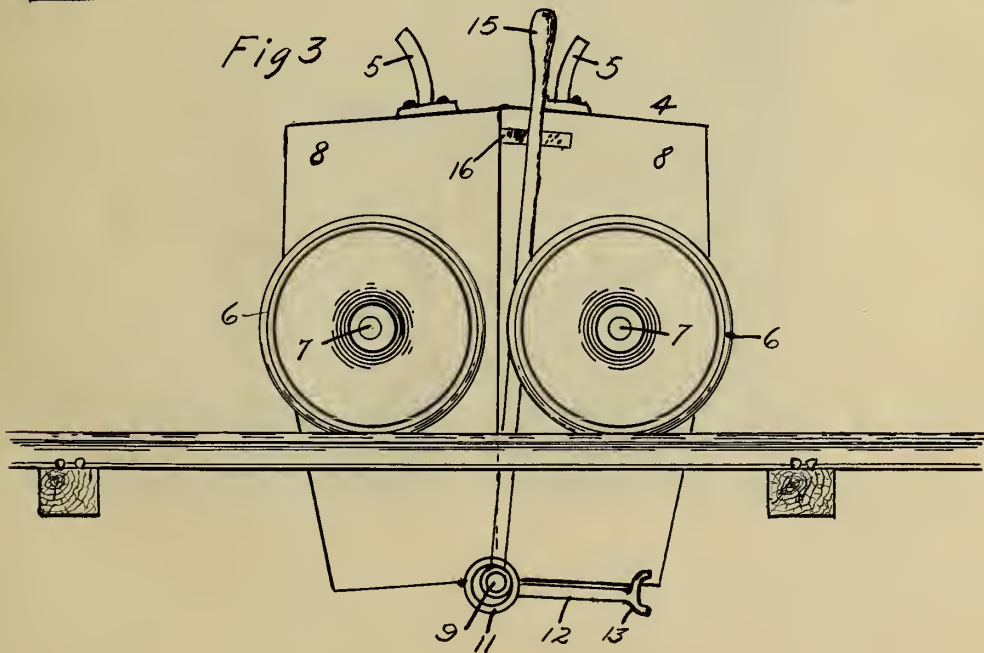
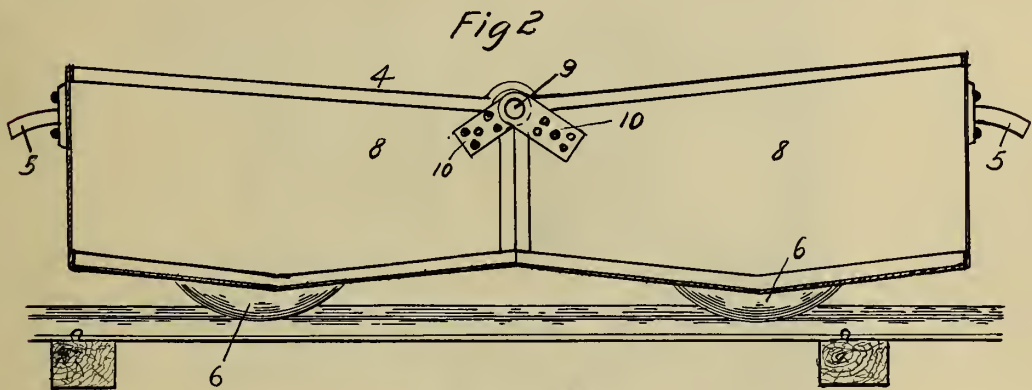
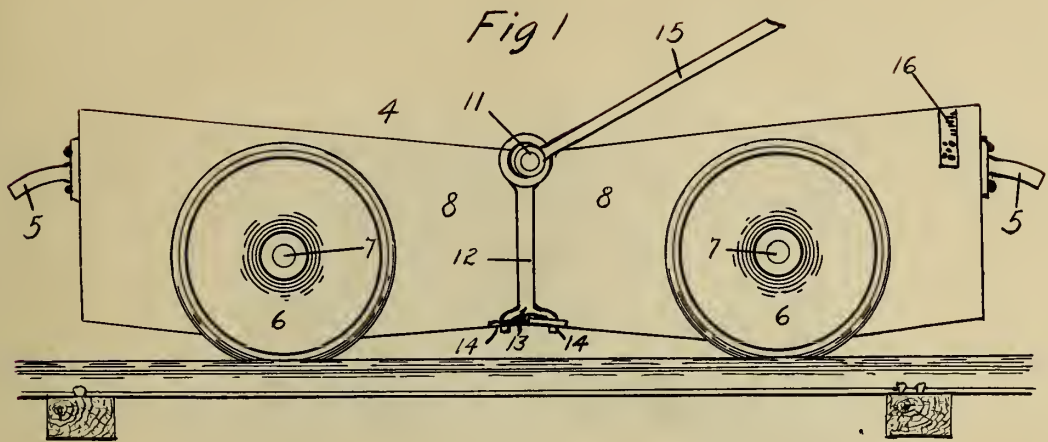
## 1. DUMP CAR.

This dump car was designed to be supported sufficiently close to the rails to enable the men to have ready access to the car in loading it, and to facilitate the loading operation by avoiding the necessity of reaching high for the purpose. The dumping of the car is readily and quickly effected and the discharge from the ends of the sections, of which the car-body is formed, is accomplished in a relatively small area. The car-body is formed in sections meeting between the wheels, which are journaled on the sides of the sections between their upper and lower edges, and hinged together at their upper meeting edges with means for releasably fastening the sections together, whereby, when the fastening means are released, the sections may be turned on their wheel axes to dump their contents.

Referring to the accompanying drawings, Figure 1, Plate I, is a side elevation; Figure 2 is a vertical longitudinal section; and Figure 3 is a side elevation of the car in a dumping position. The car-body 4 is made of steel plate, provided with handles 5 on its opposite closed ends and supported on two pairs of wheels 6 journaled in bosses 7 on opposite sides of the car-body, between its upper and lower edges, to bring the base of the latter as low as possible. The car-body is transversely divided between the wheels to form two similar sections 8, the inner meeting ends of which are open, as shown in Figure 2, to form a continuous car-body when the sections are secured together and discharge openings when moving upon their hinge connection. The sections are horizontally hinged together by a shaft 9 passing through straps 10 rigidly secured to the sec-













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tions.

To the ends of the shaft 9 eccentrics 11 are secured, each provided with a depending arm 12, terminating in a yoke 13, the ends of which are adapted to engage loops 14, extending laterally from the sides of the sections for releasably fastening the sections together opposite to their hinge connection. Secured to one end of the shaft 7 is an operating-lever 15 which operates the eccentrics 11 to raise and lower the arms; to fasten and release the sections 8. A stop 16 holds the lever when the car is being dumped.

As soon as the fastening means are released the sections are automatically turned on their wheel axes by the weight of their contents, discharging their load and automatically righting themselves to the position for loading shown in Fig. 1.

Photographs A, B and C show this type of dump car operating on 30 inch gauge tracks laid on top of a train of gondola cars containing gravel and sand. A mixer mounted on a flat car was coupled to one end of the train of gondolas and a box car, containing cement, to the other. Two cars, of  $3/4$  cu.yd.capacity each, supplied a No. 4 Smith Mixer with concrete materials. The sand and gravel was shoveled from the gondola cars into the dump cars, which are about as high as an ordinary wheel-barrow and eight feet long. The loaded cars were hoisted by the mixer engine, alternately, to the mixer hopper and ran back, by gravity, to the gondola cars to be reloaded. Photograph A shows the car in a partial dumping position.

The mixer car was self propelling; the whole train, including usually one cement car, four cars of sand and gravel, one mixer car and one derrick car, being moved at the will of the mixer engineer.

This outfit, having cars operating on top of a moving train,



proved very useful and economical in placing concrete for retaining walls on track elevation work in Chicago. A reduction of twelve laborers per outfit was possible by substituting tracks and low folding cars for wheel-barrows. A dump car, materially exceeding the height of a wheel-barrow, less than eight feet long and with discharge opening greater than thirty inches square, would not be suitable for the work, because it would be difficult to cast material from bottom of gondola car into the dump car; it would limit, to a greater extent, the number of men loading dump car and would require a larger, higher hopper over the mixer, exceeding the vertical height limited by railroad regulations for clearance, and also a steeper grade for track to hopper.

This low car operates successfully on rough track, owing to its low center of gravity. It is also suitable in stone quarries because it is a low car, facilitating the transfer of heavy pieces of stone into the car. Another application of this car is found in small tunnels, where the ordinary dump car must be of such a small capacity, owing to the limited head room, as to seriously affect the progress of the work.

Many retaining walls, from twenty to thirty feet high, have been built in Chicago, and the concrete materials were delivered to the mixer in wheel-barrows operating on plank runways from twenty-five to thirty-five feet above the ground. Common laborers are usually very awkward and it was very difficult to engage a sufficient force to work in this manner, owing to the possibility of accidents. The dump car, however, operated just as efficiently at these elevations as nearer the ground.

Two years constant use on concrete work has shown that these





cars are very durable, requiring no repairs whatever.

The ordinary hopper bottom dump car, which is more than twice as high as the author's folding dump car, has been used successfully on the Chicago, Burlington and Quincy Railroad track elevation work. Its use, however, was limited to localities where a second construction track, in addition to the regular material track, was available. In such cases the material was shoveled from the gondola cars, standing on one of these tracks, into the dump car and hauled over the other track and a portable incline to the roof of the mixer car. The cost and progress of the work, however, suffered because only one dump car can be operated in this way; the laborers being idle while the car is traveling back and forth. Another added expense is that a hoisting engine must be provided, and operated, to elevate this dump car from the track on the ground while the two low folding cars, which travel on top of the gondola cars, are hoisted up the low incline, readily, by the regular mixer engine equipped with a simple device consisting of a shaft with small drums and clutches and geared to the engine.



## 2. SKIP.

Skips are used for transfer by hoisting means when loaded with material (as stone, dirt, coal, concrete and the like) from the place of loading to a car, a boat, or boxes, and the like, into which the contents are dumped.

The ordinary form of skip is a rigidly continuous receptacle open at one end. In dumping into a car, the contents of such a skip are necessarily directed to one point beyond its center of gravity and tend to overbalance and derail it, besides wasting the material on account of its spilling from the car unless a hopper is used, through which it drops into cars moving under it. This incurs expense because of the cost and maintenance of the hopper and of requiring it to be handled and the cars to be moved.

The author's design of a skip overcomes the objections referred to, and others, by presenting the advantages of enabling the load to be dumped into a car in a manner to distribute itself from the center and avoid any waste of the material by spilling. A perspective view of this skip, Plate II, Fig.4, shows it suspended from some form of hoist, and Plate III, Fig.5, is a similar view of the same, presented with relation to the box of a car shown by dotted representation, the skip being in the folded condition to which it is reduced in dumping its load.

The body 5 of the skip consists of two hinged sections 6 and 7, adapted to be folded on their hinge connections in an upward direction. The hinges are made up of upwardly projecting perforated ears 8 and 9 and pivot pins or pintles 10.

For hoisting the skip it is provided with eyes 11, connected by





Fig 4.

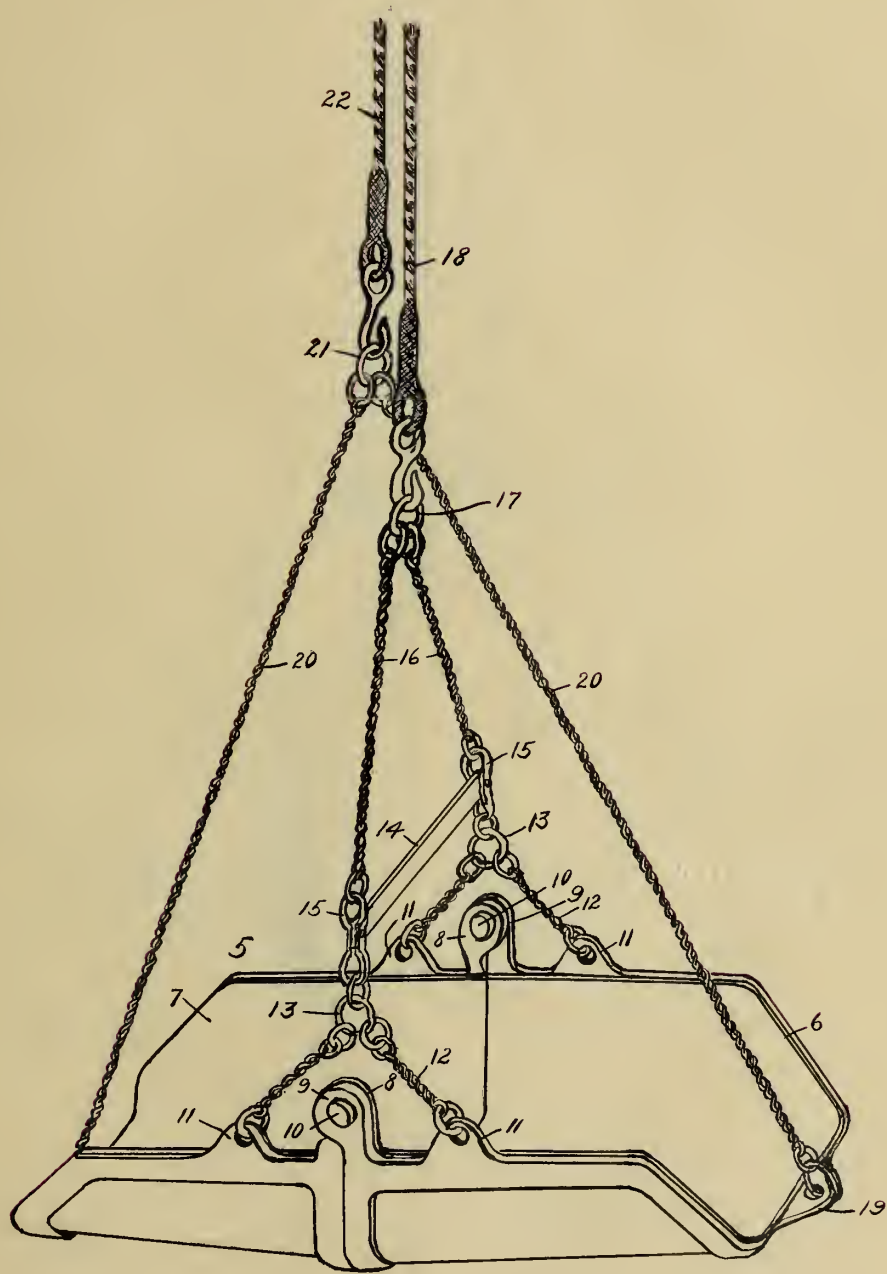
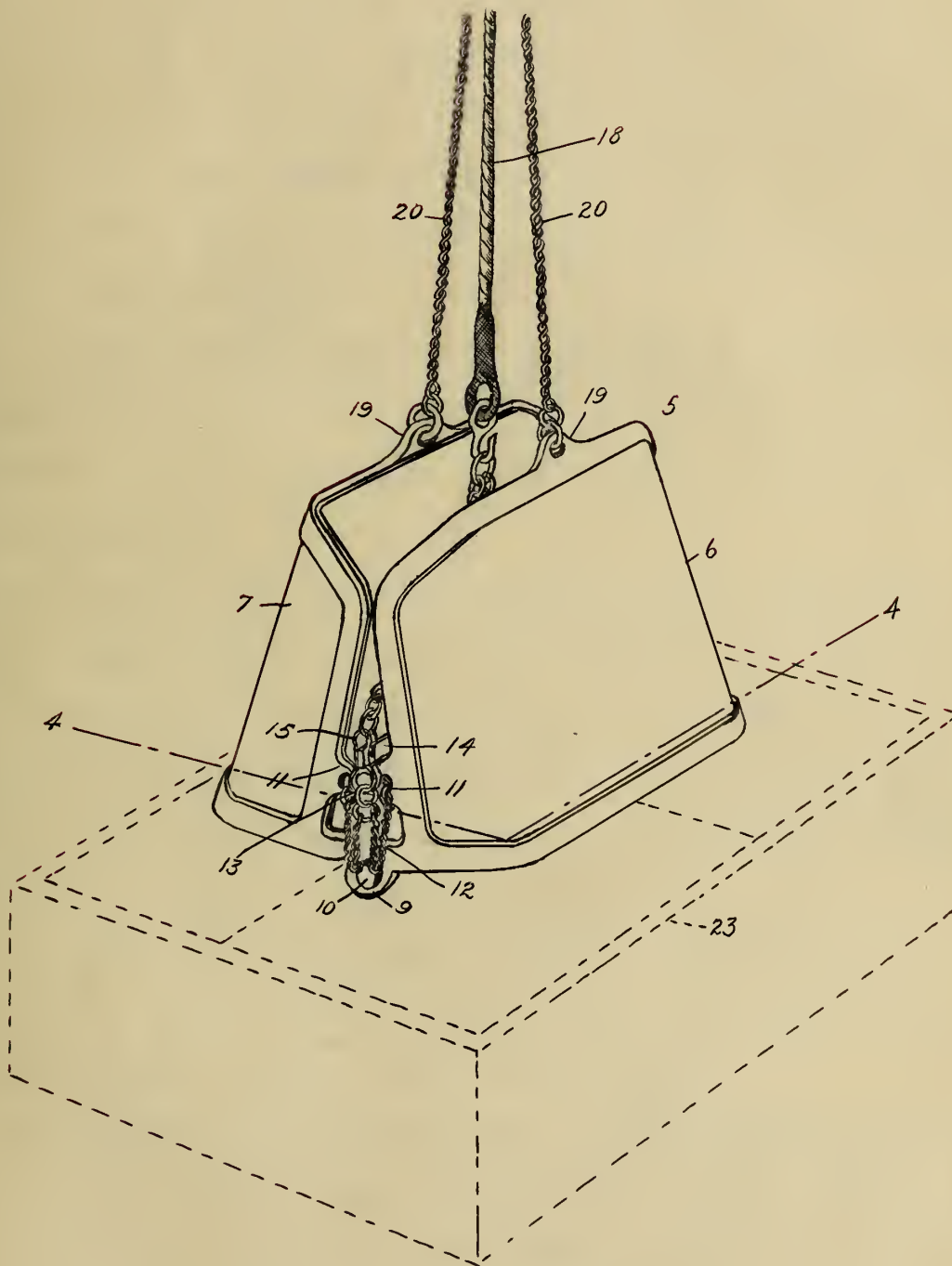




Fig 5







chains 12 containing midway between its ends rings 13; the two rings are connected by a spreader-bar 14 at clips 15, pivotally supported on its ends and connected by a suspension chain 16 containing midway between its ends a ring 17 in which to hook the hoisting cable 18 depending from a hoist. (Not shown). Similar eyes 19 project centrally from the outer ends of the base of the divided skip at which to connect the dumping chain 20, containing midway between its ends a ring 21 in which to hook the dumping cable 22 connected to the second drum of a hoist.

The loaded skip is kept in its unfolded, or expanded, condition when supported by cable 18 until it is moving into position over a car, when this cable is released and the skip is folded by supporting it by the cable 22.

The loading position of the skip is on the ground, as in a stone quarry, the open ends permitting heavy stones to be rolled into the skip, the chain 20 lying out of the way to one side of the skip, being unhooked from the cable 22, as is the cable 18 from the chain 17, which, with the chains 16 and 12, may then lie loosely without obstructing the loading operation.

In dumping into a car, each section forms a chute with an open discharge-end and the contents discharge at the center of the car, whence they spread over its entire inner area.

The corners of the sections are somewhat rounded to prevent the skip, in the event of its turning while dumping, from spilling over the car sides. The skip sections are tapered or flared toward their hinged ends to remove all possibility of clogging in discharging wedged material between the sides of the skip.

These skips were designed for use on rock excavation for pro-



posed power house at Dresden Heights at the mouth of the Des Plaines River.

It will generally be more satisfactory to add, and use, hooks at 13 and 19 and to discontinue to unhook the two hooks attached to the hoisting cables, especially when two or more skips are used in connection with one hoist, for two reasons. First,- the slacking of the hoisting ropes before attaching same to one of the loaded skips will be more quickly effected, due to the weight of the chains; and, second,- only one set of long chains is required no matter how many skips are used.

Skips of one cubic yard capacity should be built of boiler plate three-eighths of an inch thick and reinforced on the edges, as illustrated, with steel bars three-fourths of an inch thick and three inches wide. This heavy construction will resist the excessive wear and abuse to which skips are invariably subjected, if used for handling heavy stone.

Aside from the economy resulting from reducing the quantity of material spilled from the car, it is believed that a material reduction in the cost of maintenance of both the skips and the cars into which the contents are dumped will be effected whenever the ordinary skip ( with one discharge opening) is replaced by a folding skip as herein described.

The folding skip when used for transferring material requiring to be shoveled, or of a semi-liquid character, should have both ends closed.

The advantages of the folding skip, over the skip which has been in extensive use for years, are apparent no matter what kind of material is to be transferred.





## 3.- Cable Thimble.

The design of the cable thimble presented is an improvement in the type of thimbles, employed for wrapping about it and securing the end section of a heavy rope or wire cable used, for example,-- for carrying a clevis, or the like, attached to an object to be hoisted or to an anchorage.

The primary object of the design is to provide an novel construction of a combined thimble and clamp, which shall serve to effectively clamp such cable-end and permit the operations of applying it thereto and disconnecting it therefrom to be performed expeditiously and with comparative facility.

In the accompanying drawing, Plate IV, Fig. 6, is a plan view, partly in section, of this device with a cable end portion shown clamped thereto by dotted representation. Photograph D clearly shows a cable firmly clamped around the thimble. Plate V, Fig. 7, is a section on the irregular line 2; Fig. 6 and Figs. 8 and 9 are broken sections respectively on the lines 3 and 4 of the same figure.

The essential feature of the design is means on the thimble of serving to secure a cable bent about the groove in its edge portion from slipping out of such a groove under the strains to which the cable is subjected in use.

The thimble 8 shown for illustrating the author's improvement is one in common use as to the general heart-shaped form of its body portion, centrally from the larger end of which projects a stem 9 containing an opening 10, the opposite end terminating in a central stem-like extension 11.



Fig 6

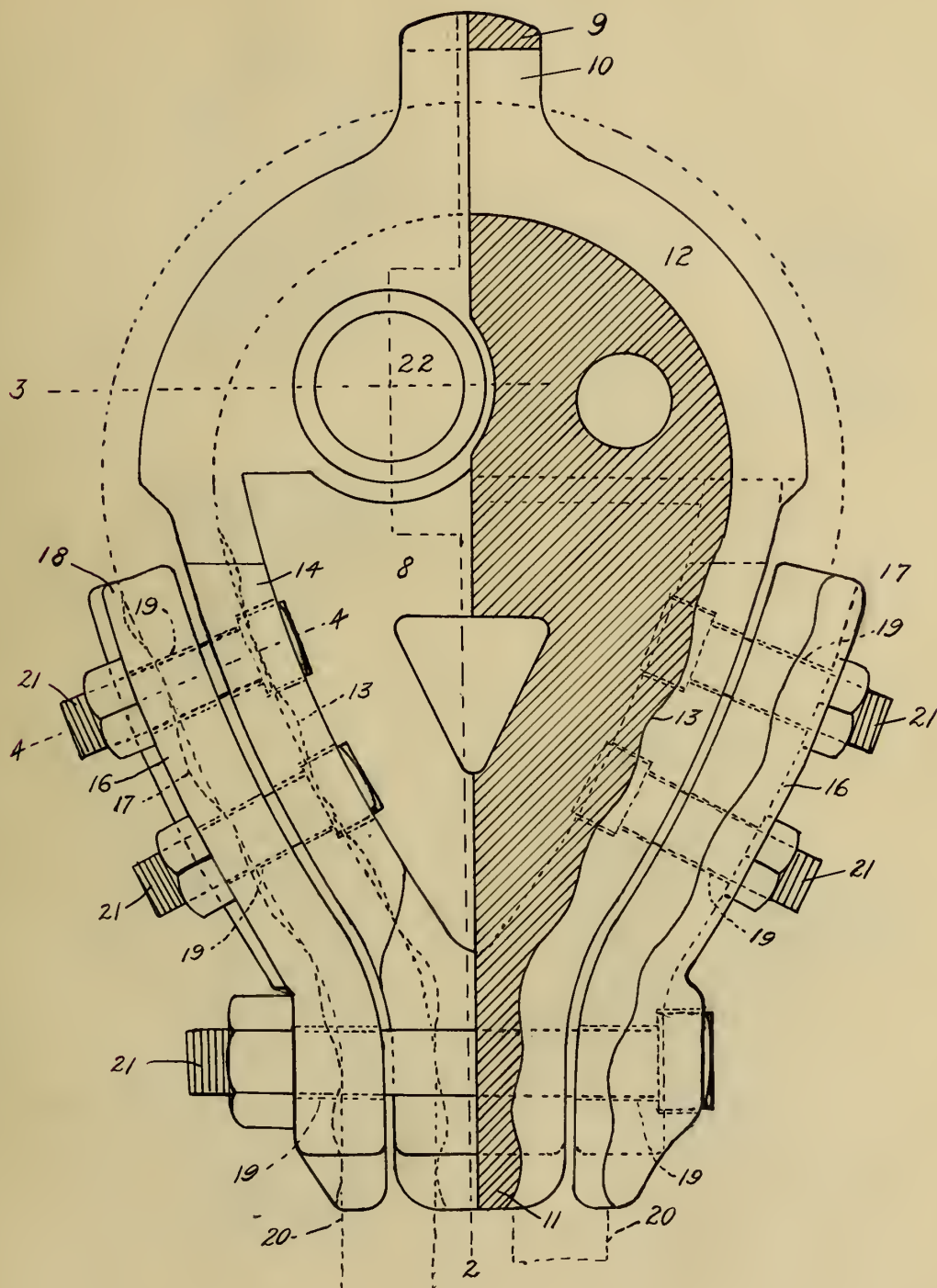






Fig. 7.

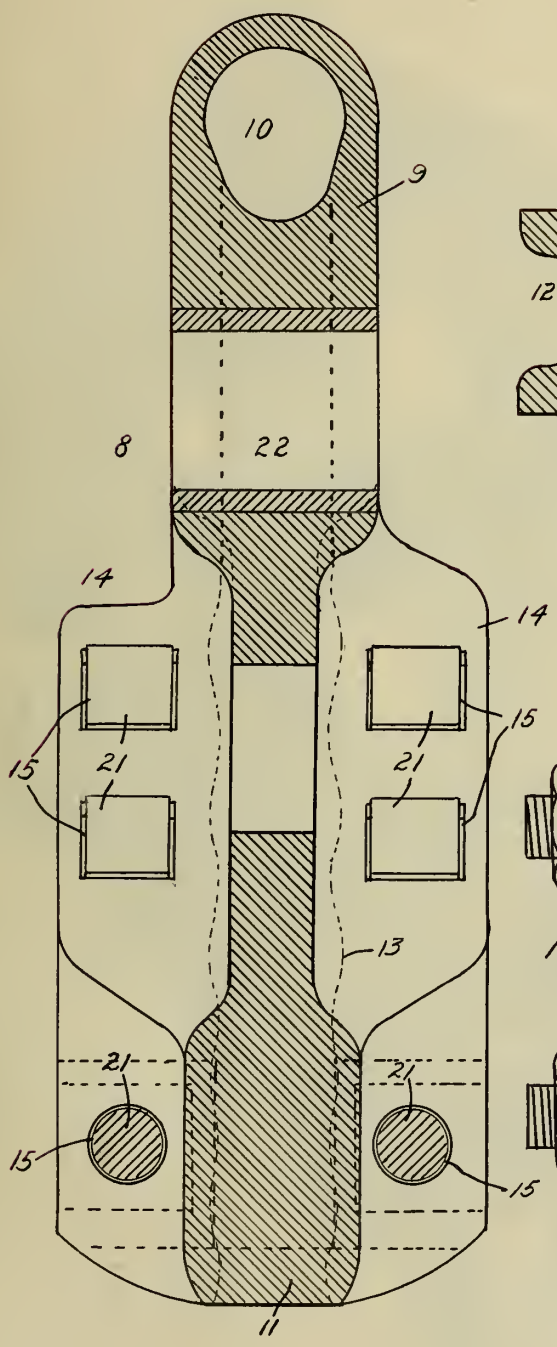


Fig 8

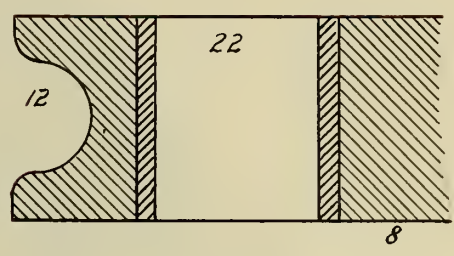
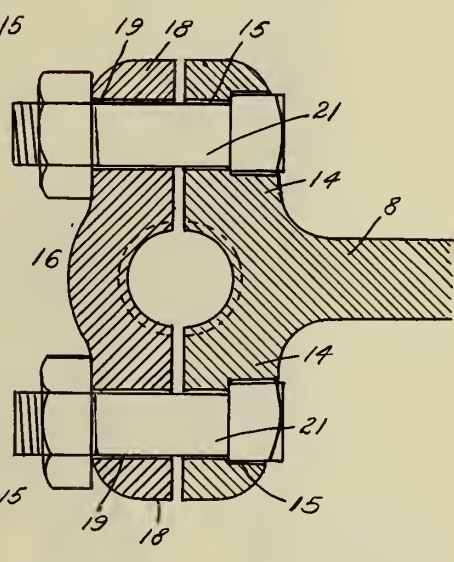


Fig 9







D

Christie Photo.  
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A groove 12 is provided about the edge of the entire flat-sided thimble-body and along the sides of the extension 11, and it intersects the opening 10. The base of the groove presents an undulatory gripping surface, shown at 13, extending along the edges of the thimble to its bulging or head portion from the extremity of the stem-like extension; and flanges 14 project at right angles to the thimble along these parts of its sides and contain bolt holes 15. Similar clamping caps 16, which contain longitudinal grooves 17 having undulatory bases like those of the sections of the groove 12, conform to the latter and their flanges; the flanges 18 of these clamps containing bolt holes 19 to register with those on the flanges 14.

To clamp the end portion of a cable 20 on the device described, it is passed through the opening 10 and bent into the groove 12 about the thimble, when one cap 16 is applied in place and fastened by bolts 21 passed through the holes registering therewith in its flanges 14, whereupon the other cap is similarly secured in place.

The hole 22 shown in the thimble receives the clevis or other medium (not shown) for connecting the cable with an object to be handled or to an anchorage. This hole is in the line of draft on the cable for the purpose of reducing to the minimum the tendency of the draft-strains to slip the cable about the thimble and to outward strain against the adjacent nuts.

The thimble is made of cast steel; the dimensions of same, as regards strength, are determined in the same manner as for sheaves.

The improved type of thimble described herein may be applied wherever a cable thimble is needed, and if the strains on the cable are severe or the end of the cable is handled in a rough manner, as



in excavating machinery, its use can hardly be dispensed with.

In the usual forms of thimbles, the cable-end projects several feet beyond the stem of the thimble to afford room for a number of separate cable clips to be used. This method requires a longer cable, and a corresponding reduction in working length of cable over a sheave results, and the thimble may frequently drop out of the loop in the cable no matter how much time is spent in securing it. The loop of cable is then permitted to assume a dangerous bend around a pin and the life of the rope diminishes.

#### CONCLUSION:

The extreme simplicity of these mechanical appliances makes them applicable to the extent herein set forth, and the author believes that their use will demonstrate great economy on construction work.



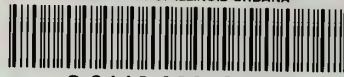








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